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What is this document

This document collects the ideas that emerged during early design meetings at Apple. The first few meetings were about the general notion of an Apple multimedia CD-ROM and what features were important. The working group continued without a break after the idea of using the Whole Earth Catalog emerged. The members of the working group were Steve Weyer, Mike Liebhold, Andy Poggio, Tim Oren, and Ted Kaehler. Stewart Brand and Kevin Kelly also contributed during a visit to Apple. Tim Oren made these notes.

The notes do not form a coherent design. They are at most tentative proposals, but more often simply issues to think on. The medium probably gives them more dignity than deserved - imagine semi-legible notebook scrawls if it helps. More concrete items come first, more speculative items toward the back. Since there is no real narrative flow, read in whichever direction suits you.

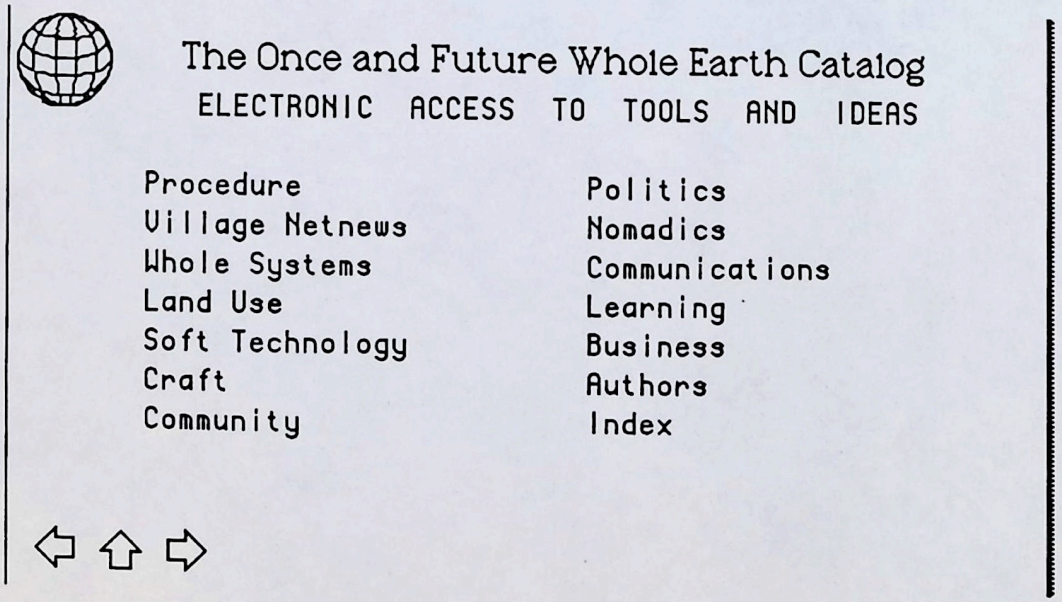
Structured (hierarchical) access

The simplest model for an electronic WEC is a replication in Wildcards of the hierarchical structure of the print original. Assuming that we use its elaborate topical structure as the main hierarchy, we are given a number of design problems. How do we render the topical index into cards? What is the structure of WEC articles and how can they be broken into cards? What other hierarchies should be superimposed on the basic architecture?

This section and the following article organization section comprise a "straw man" proposal for discussion. It deliberately omits techniques which take more advantage of the medium (to be discussed below). A very small mockup WEC using these conventions has been built for demo purposes.

The main topic outline in the front of the WEC (I'm using the "Next" edition) has about a dozen major topics, each with twenty to fifty subtopics nested below.

This can be handled with a hierarchy of cards. The top level card has one button for each subtopic. The "up" button returns to home. "Previous" and "next" might transfer to the root card of other hierarchical views.



The number of subtopics requires multiple cards for each main topic. Notes from the beginning of the subtopic in the WEC text are moved onto these cards. "Up" returns to the top level card. "Previous" and "next" move among subtopic cards. You can continue into another subtopic without returning to the root. Each subtopic button jumps to an article header in the text stack. The Whole Earth icon returns directly to the root.

Nomadics

To travel, you might want a Swiss Army Knife, but all you really need is a self-editorial that begins, "Fuck it..." - SB

Travel	Camp skills
Asia	Foraging
Latin America	Mushrooms
Road life	Survival
Cars	Winter
Bicycling	Mountains & caves

It is easy to build more than one hierarchy over the same base material using Wildcard. An obvious candidate in the WEC is the word index from the back of the book. Again, this could be made into a root card, with links for each letter of the alphabet, reaching lower level cards with alphabetically ordered links to articles. In a word index, the link may end within the article text, rather on its header card.

We should explore other indices to be added to the WEC. Since several of the main topics are "kitchen sink" categories, it's likely that there is more to be gained here.

Article organization

Most of the WEC articles follow a standardized review structure. They consist of a title, a review whose length varies from one to a dozen paragraphs, access information, and a "sample of the goods". The access information includes title, author, publisher or provider, price and ordering information, and a picture of the book or product. The sample is several paragraphs of text from the book or catalog and further pictures from the book or of the product.

The top of each WEC page carries the running topic and subtopic headers, and the page number. The bottom right corner has the "Neighborhood Newsletter" with a flip-book graphic as a corner bleed.

Our back of the envelope estimates show that the WEC as its exists along with bit images of all of the pictures will come to about 20MBytes and will trivially fit on the CD-ROM. We can use this opportunity to include a wider range of material, by incorporating new work by Whole Earth (Signal, for instance), or recovering material which ended up on the cutting room floor. Stewart suggests that the richness of each articles should be expanded to be closer to the experience of picking up the item reviewed in a store and examining it. The texture of the reviews can be changed to multivoice give and take as more space is available.

The article begins with a single header card. It contains a title and topic block and a text area. In the title and topic block, clicking on the Whole Earth icon or the major topic returns to the hierarchy root. Clicking on the subtopic jumps back up to the appropriate subtopic card. Clicking on the previous or next arrow jumps sideways to an adjoining article header. You can move sideways into the next subtopic without returning to an index card. The article title is inactive on a header card.

The first paragraph of the review appears in the text area along with links to the access information and samples sections. Clicking in the bar below the text "flips the page" to the next card. Page turning moves linearly through the article, and finally into the header and body of the following article. The bar above the text flips pages backward. The "sidebars" are described below.

COMMUNICATIONS
CYBERNETICS & LANGUAGE

⇦ An Introduction to Cybernetics
Design for a Brain (Review)

AN INTRODUCTION TO CYBERNETICS
DESIGN FOR A BRAIN

We are migrating from a world governed primarily by the laws of thermodynamics to a world governed primarily by cybernetics - a weightless world (Fuller says "metaphysical") whose events are the impinging of information on information. Wiener† is a good philosophical introduction to this world; Bateson† is a peerless cybernetics-inspired philosopher; but Ashby is the profoundest practical introducer, profound enough to be scarely dated decades later in one of the fastest growing fields we have. - SB

ACCESS

SAMPLES

The body card is very similar to the header card. The access and sample links are missing, and clicking the article title will return to the article header card. The title area also displays the current article portions being displayed (review, access, or sample).

Body cards are used for the remainder of the review, for the access information (usually a single card), and the text and/or image samples.

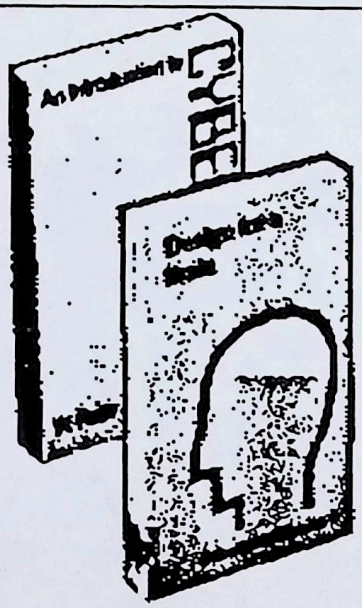
COMMUNICATIONS
CYBERNETICS & LANGUAGE

⇦ An Introduction to Cybernetics
Design for a Brain (Access)

An Introduction to Cybernetics
W. Ross Ashby
1956; 295pp.
$10.95 postpaid

Design for a Brain (The Origin
of Adaptive Behavior)
W. Ross Ashby
1952; 286pp.
$11.95 postpaid

both from:
Metheun
757 Third Avenue
New York, NY 10017



Unstructured access

"Unstructured access" is used as a term for "sideways" links that are not part of a hierarchy or heterarchy. Some of these links will relate articles which are already cross-referenced in the print WEC. Others will be designed to promote discovery .

Existing sideways links are occasionally of the form "see p. xxx", but are more often by title and are marked casually or not at all. Textual analysis will probably gain little here; it will be an editorial job to find and link these points, and add others as appropriate.

Another class of sideways links is suggested by the labeling of all reviews and articles by author. It is easy to link each author's contributions together and create a subtopic card from which each author's chain originates (see the demo for an example). Browsing the chain gives an interesting view of both the author and the WEC. Like many of the sideways browse ideas, the "author-ity" path generated will weave through diverse topics, and may be the occasion for discovery.

An important issue for the electronic WEC is restoring the opportunities for serendipity which exist in the print versions. For instance, pictures are prominently placed (as a matter of design) to draw the eye while paging through the book. The Newsletter and flipbook animation in the page corners are reasons for page turning which may lead the reader to topics s/he would not normally have selected directly.

The Newsletter format could be adapted by using marginal areas of cards with spare space. This would not reach every card, but at least one card from each article seems a reasonable goal. (There are examples of this in the demo.) Weaving the links through the WEC text cards rather than taking sequential spare-space cards might enhance the serendipity effect.

We could also use a "timed-link" Wildtalk program (if possible?) to implement the "flipbook" animation in card margins. Clicking on one image would start the animation running until another click. Again, the possible benefit is an impromptu tour of new material, in this case with hands off. Other realtime tours suggest themselves: audio narration or background music played from the CD-ROM audio channel or using the Mac's sampled sound capability; small animation or simulation gadgets that demonstrate relations among a set of articles (solar energy, water cycle, and land use, for instance).

Any touring mechanism that may end a long way from the starting card should have a reverse mechanism. Backward links might be useful, but not all tours will be "invertable". A return to origin key or button is a minimum.

It may be useful to recreate serendipity effects caused by physical contiguity of articles on a single page or facing pages. The "side bars" on the demo article cards are intended for linking to "adjacent" cards - which might be header cards or body cards, but are probably not in the previous or next articles. Since there is no constraint to a two dimensional surface, which card is "next-door" is completely a matter of design and might be used for informal cross references, or as an (weak) editorial suggestion of correlation between topics. One drawback of the technique shown is consumption of precious screen space.

The limit case in serendipity is a completely random jump, comparable to letting the book fall open. This ability is easy, but we might consider some pseudo-random options. For instance, take the "hint bits" from the current card and look for loose match following the random jump point, and use a deeper analysis of the text for "free association" to another card.

New material

The ideas above have been (loosely) derived from the printed version of WEC. Topics in this section have no such correspondent, and attempt to press the limits of the medium farther. . .

The Ruby CD-ROM drive will have the ability to play CD audio as well as read digital data. Also, Wildcard has its own ability to play sampled sound and synthesized notes. We should exploit these capabilities to differentiate the CD drive and the Whole Earth disc and explore the interaction of hypertext and realtime elements.

A simple use of sound is to form part of the "data" in an article. A review of a recording could have small snippets of sound triggered by clicking a button. An article on music instruments can have examples of their sound. Certain works (such as the Voyager sound disc) which are unapproachable in the print medium become very interesting using this capability.

Sound can also be used as a voiceover for articles, perhaps coupled with automatic card flipping when appropriate. To undertake this, we will have to elaborate realtime synchronization in Wildcard so that the user can smoothly regain control at any time. Time-linked tools or controls become important. For instance, we might want to create a menu with forward, stop, rewind, fast forward, and so on. The issues of multithreading and temporal elements in Wildcard are raised.

A more subtle use of synchronized sound is background music. It might be interesting to see if "theme music" can help in the general location and navigation problem or as a signature for tours. This is less demanding than voiceover, but requires at least a kill audio command for those who found it objectionable. Perhaps it should only occur on a non-hierarchy entry to a card? Or only on the first few accesses?

As suggested earlier, sound can be used as "marginalia". That is, the sound program may be unrelated to the card in which it starts, and is used as the realtime driver of a tour that gives a gratuitous walkthrough of the WEC.

For all of these uses, we will have to design graphic elements that indicate the presence and nature of the sound experience. It would be annoying if a tour left the station without warning!

Graphic animation sequences, canned or program driven, are a good way to show off the Mac and/or GS, and bring up challenging issues of synchronization and simulation. Again, canned "flipbooks" in the margins give impromptu tours. Animations or simulations could also form part of the body of an article. We might try some real "how to do it" cartoons within articles, or simulations that can be manipulated by the viewer to exhibit an effect under discussion. Such simulations would press the limits of Wildtalk as a language, and the speed of Wildcard and the Mac. Animations with branching points "a la Aspen" are a mid-point between linear presentation and full simulation. They could be used as micro-tours of the subject of a review, or form the basis for more advanced browsing (see below).

We have specified one capability for the Ruby drive (acceptance is not final) which is useful in this context: streaming (degradable) digital data from one "channel" of the CD while playing monaural audio from the other. This would give us the capability of transferring about 50KBytes per secound while the audio was running. This would be adequate for a "fast slide show" or (perhaps) full animation using a "tweener" , though the latter would not be fully robust.

We could build a browser from images of the Whole Earth Access store. The images could be collected with a videocam and a frame grabber and merged into

Wildcards. Navigation would be with mouse clicks on hot areas in the image. After finding an item of interest by "walking" the aisles and zooming in on a shelf, a click on its picture would jump directly to the review. Again, we might be able to animate the sequences depending on performance of the CD drive and a "tweener" residing in the CPU. A store browser might be a very natural ways to look at the WEC. Stewart made the point that people learn to shop, and we might be able to transfer the conventions to the electronic medium.

The discussion of tours to this point has concerned their use in promoting serendipity. Of course, canned tours are also of interest in their own right. This section considers some variations on this theme.

As a starter, the tour by author mentioned early could be deliberately augmented by each author, to include a path through articles that s/he belives to be related, along with notes on the relationship to the author's own work.

This generalizes to arbitrary personal tours, conducted by the those functioning purely as commentators. One could weave a rich carpet of commentary on the basic material. We might ask experts in various fields to give their views, for instance, Stewart or Alan, Ted Nelson, Ken Kesey, and so on. This would interesting not only as an access mechanism, but as a snapshot of the thinking of the commentators.

Tours might also express a particular point of view. There could be tours for urbanites, farm dwellers, suburbanites, for aged and young, for male and female, for coast, plains, or mountain dwellers, and so on. The direct value is guidance to topics of greatest personal interest; the indirect value is access to others' points of view.

Tours can also be thematic. One could tour articles related to science, to history, to music, and so on. Features of the database itself can be used in generating tours, for instance, browse by pictures only. As the tour rationale grows more general, there is more potential for creation of a general tool rather than explicit links. For an example, see Fabrice Florin's Worldview demo, which uses hardwired but consistent thematic browsing.

Finally, and perhaps most obviously, the end-user should be able to construct tours also. This implies the abilty to add links, cards, and annotation. Since the basic material is coming from a nonwritable medium, this presents a challenge to Wildcard to accomodate versioning from a harddisk or other writable medium.

An issue appearing everywhere in the project is the analysis of the human/computer interaction. We cannot slavish adopt the Mac paradigm; design of this interface has focused on the active user in a productivity situation, where planning and problem solving are the primary cognitive tasks. With this project we are venturing into design for learning, which is less understood, and (to some degree) entertainment, which is virtually unexamined. Rethinking is certainly necessary; Wildcard itself is a step in this direction.

The variable role of the human is an interesting point of analysis. The preceding outline touches on purely "user" modes of activity, such as browsing a topic index, as well as passive"viewer" modes, listening to audio and/or watching animations and tours. Experiences in the middle ("participant" mode?) would be a useful subject for exploration. Graceful yielding and recovery of the focus of control by the machine is desirable. We don't have the required reality of simulation, or size of storage, or production time to make such shifts arbitrary. What conventions work to indicate space/time points where exchange can occur? We should be looking for something better than stop and branch!

"Second order" issues

This section is (loosely) about the troubles we can get into by doing the preceding ideas. Particularly, a large hypertext universe is going to suffer from problems of location, closure and state preservation. Where am I? Where is topic X? How do I get there? What is around me? Have I seen all of this topic? How much is left in this chapter? Am I done with the book? How do I turn down the page corner? Hey, I can't scribble in this book!

The effective viewing area of the print WEC is large, two oversize facing pages. In Wildcard, the viewport is one screen, approximately equivalent to a print paragraph. Rather than encompassing several articles,the viewport may be a small part of a single article. Not only are the visual clues to location missing, but there are more individual pieces to consider. It's simply easy to get lost. How can this be overcome?

One method is neighborhood or context views, which display some or all of the nodes which are linked to the current card. Note that the Wildcard totally lacks this capability at present. Assuming that we will need it for a CD-sized hypertext, what might it look like?

One possibility is a "wiring diagram". This might look something like a PC board layout with miniature cards installed on a grid pattern with the current node at the center, and a quick and dirty router to display the links among the nodes shown. Such a view could also be used for "direct manipulation" creation and editing of links, which would later be "tacked down" inside the individual card.

To allow more nodes in one view, some projects such as MCC's SemNet have adopted simulated 3-D viewers. The user can "fly" through the node space in a simulated vehicle and adjust viewing parameters. This approach has a real problem with visual clutter, no obvious relation to the material being browsed, and the need to learn a set of arbitrary controls. Steve's comment is "spaghetti looks the same from any perspective."

Distorted views are an alternative to the literal approach of showing all adjoining nodes. Two types of distortion are filtering and focusing. Filtering can be applied by dropping out nodes whose links from the current card do not meet a filtering criterion. So we could (using the earlier ideas) ask for a neighborhood generated by hierarchical links only, or along tour or narrative paths only. This may drastically reduce the branching factor and allow showing several plys of neighbor nodes. Notice that filtering requires the labeling of links by type.

I am using "focusing" to mean generating of a view by a more complex criterion function. A good example is Furnas' fisheye viewing technique, which may drop nearby nodes in favor of more distant, but heavily weighted nodes. Choice of a weighting function determines the value of the view to the user. I have had some success with views weighted by connectivity. Weighting by approximate match to the "hint bits" of the current card, or generated by a term list, might be interesting.

Focusing can produce views in which visible nodes are not directly attached to the current card. Visible links might be abandoned in favor of some arbitary titling and positioning, or the intervening nodes might be sketched in when a distant one is selected.

A common drawback of these schemes is the requirement for the user to leave the material at hand for a more distant vantagepoint. One partial solution might be "locating seques" during jumps from card to card. Ted suggested a "pogo-stick" seque: during a jump the view automatically zooms out to the neighborhood level, pans to the new node, and zooms back in.

Other types of peripheral clues might be used within the card. Bill suggested

that the background dither or style of card edge could form an effective cue to level within a hierarchy, for instance. Visual or audible themes associated with tours are also possible.

One very simple approach to the location problem is to editorially create "page layouts" that form effective neighborhoods for the articles. This is really an instance of general "contiguity browsing", as with maps or timelines. We might well adopt such familiar print conventions of wayfinding. These could be used to create alternate neighborhoods for each article. Timelines might be generated by considering each tour passing through the card as a separate script, generating its own neighborhood.

The user should be allowed (encouraged!) to create such card layouts. They would be an effective tool for building up new concepts from individual cards, and would be a direct statement of relevance to be exploited in word search. Encouragement implies an effective tool for building! A precedent is the file box metaphor using in PARC's Notecards, which encourages casual rearrangement of neighborhoods. (Creation of a different kind of node for the purpose is probably needless multiplication of types, however.)

One approach to the closure problem is to keep a record of cards and links traversed by the user. A convenient place to store this information would be card and button variables. This would make intense demands on Wildcard versioning, probably necessitating the use of delta storage at the card level, rather than replication of the entire alterred card.

Once the user's paths have been recorded, agents can act on this memory. One might ask whether all nodes in a neighborhood have been visited, or request to be shown something new, or be shown a new approach to a previous card, or new cards using a favorite link type. As the memories of user action accumulate, preferences for branching type and de facto neighbors could be deduced.

State preservation means that a printed book, being a physical object, doesn't change when you aren't looking. Page corners can be turned down, markers inserted, notes and references added in the margin, passages highlighted for review, or several fingers inserted while following references through the work. We should (at least) preserve these properties in the new medium.

Position marking is the most easily accomplished. Wildcard's history card handles many of the cases. The addition and use of neighborhood cards as bookmark collections should be extensible to the remainder.

Annotation can take place in at least two ways. If room remains on the existing card, one can simply insert marginalia. If more room is required, a button which jumps to a another card can be added. An analog for Post-it notes might be nice, presumably generated with some type of opaque button which could later be "pulled off" and moved or discarded. The Guide hypertext program has an interesting pop-up note capability which allows the note to be hidden until the mouse button is held down over a link.

Again, any annotation on existing cards or addition of new cards implies a versioning facility in Wildcard which is currently lacking. Since the underlying CD database will not change, we also have the option of making additions and changes personal, viewed only by their creator, or shared amongst all users of the CD, or a combination.

Search is a way to find a starting position in the hypertext net, or reach an unknown node or one which is out of sight. Wildcard will implement a full text

algorithm using surrogate coding or "hint bits" per card. The first version is designed for hard disk characteristics, and will require reoptimization for CD-ROM.

Boolean full text search is known to be a flawed technique. There are severe tradeoffs between precision and efficiency of recall, brought on by inconsistent use of terms and lack of any understanding of the material. The hypertext method itself ameliorates some of the problems since "close" may be sufficient if there are links connecting a a node found to the others of interest. Thus, nodes missed because of efficiency failure may be found by linking, and extraneous nodes selected due to precious failure may be safely ignored.

We might also consider other search methods. Surrogate coding is itself a weak form of vector coding of the nodes, since it maps the words into a bit vector (though the relation is not invertable). It should be possible to extend this method to approximate or fuzzy matching, allowing the use of weights gathered from other clues.

Hypertext lends itself to finding such clues by relevance analysis. Even unlabeled links can be used as a spreading activation net from previously viewed nodes. Patterns of hierarchical or sequential tour links between previous and candidate nodes may generate relevance measures. The use of cross-references for bibliographic and cocitation analysis is well known in databases of scientific papers, and should transfer well to hypertext since the flow of ideas is similarly indicated.

We could set up such search methods to run in the background, continually updated the most relevant list as the user browses the hypertext. Jumping to the current best guess is then a low overhead choice. If several such background methods with different criteria are turned loose, we have effectively created agents.

None of the previous methods go beyond the single word level. We should consider possible gains by shallow and or deep analysis of the text within the cards. At a minimum, we should be able to filter out buzzwords from the surrogate code and so increase its efficiency. Even fragmentary analysis of the text may provide a basis for suggesting links, constructing free association chains, or generating criteria for agents.

Link tagging or typing has been mentioned several times. It may be desirable for distinguishing hierarchical links from tours from cross-refererences from annotations, for instance. Type distinctions appear useful in view filtering and relevance analysis, at least. If this method is adopted, a mechanism must be provided in Wildcard. (An "on type" method is simplest, but probably inefficient.) Additionally, we will have to codify the various link types and come up with editorial conventions for applying them.

Other ideas

This heading is a grab-bag of ideas on adapting the WEC to the electronic world, but not particularly related to hypertext.

The original WEC catalog contains explicit material that will be unacceptable to part of the audience for the prospective CD. We could simply drop the material as part of a general topic shift, or seek mechanisms to hide it from unappreciative viewers. The simplest way is to literally hide it, that is, make it hard to get reach, so one wouldn't find it without a deliberate search. Unfortunately, the very serendipity and word search capabilities we want to design into the entire system would make hiding places valueless.

The tougher way is to design a "ratings knob" which can used to tune out objectionable material. Presumably this requires a password to activate. Cards and articles beyond the current setting disappear. This creates some problems. What about tours that pass through the missing cards? Do links to these cards disappear, or cease to work, or give warning messages? In sum, how do you remove part of a densely connected hypertext without leaving an obvious gaping hole?

The Whole Earth CD has great tie-in potential with the Well and other data communications services. For instance, a button in each article's access card could add that item to an order list. At the conclusion of the run, the order list could be transmitted by modem to the Well, for fulfillment by the Access Store. This could be expanded to cover multiple suppliers and datacom providers. As a fallback, the order list could be printed ready for mailing, separated out by supplier.

The Well could also be used for feedback and submission of new Whole Earth CD articles. Since the underlying cards are fixed, new decks are completely portable to any other system with the same CD. This means a reader can very easily turn into a writer, and submit the result to Whole Earth in its hypertext form. Stewart suggests including "How to make a Whole Earth CD", including guidelines for reviews and articles, within the work itself.

In fact, the fixed nature of the CD creates a potential aftermarket for piggyback material which refer to the underlying hypertext. New indices, incremental updates, tours and commentaries could be distributed on magnetic media by Whole Earth or other companies.